1. Induced e.m.f. = $-NB \left( 2R \frac{dR}{dt} \right)$

2. Current leads, mean $V_C > V_L$

$\tan 45^\circ = \frac{V_C - V_L}{V_R} = 1 \Rightarrow V_C - V_L = V_R$

$X_C - X_L = R$

$\frac{1}{\omega C} - \frac{1}{\omega L} = R$

$\frac{1}{\omega C} = R + \frac{1}{\omega L}$

$C = \frac{1}{2\pi f (R + 2\pi f L)}$

3. Using mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

Multiplying with $\mu$, $\frac{u}{v} = \frac{-u}{f} + \frac{f - u}{f}$

$m = \frac{v}{u} = \frac{f}{f - u}$

Now $|dv| = m^2 |du|$

$\text{size of image} = \left( \frac{f}{f - u} \right)^2 b$

4. $\sin \theta = \frac{\lambda}{d} = \frac{6000 \times 10^{-10}}{12 \times 10^{-10}} = \frac{1}{2}$

$\theta = 30^\circ$

angular width of central maximum = $2\theta = 60^\circ$
5. By momentum conservation law
\[ 0 = mv - 4mv + (A - 5)mv^1 \]
\[ v^1 = \frac{3V}{A - 5} \]

7. \[ X_L = \omega L = 2000 \times 5 \times 10^{-3} = 10\Omega \] and
\[ X_C = \frac{1}{2000 \times 50 \times 10^{-6}} = 10\Omega \]
Total impedance of the circuit
\[ = 6 + \sqrt{(R)^2 + (X_L - X_C)^2} \]
\[ = 6 + \sqrt{(4)^2 + 0} = 10\Omega \]
Ammeter reads r.m.s. current so it's value
\[ i_{\text{rms}} = \frac{V_{\text{ms}}}{\text{Total impedance}} = \frac{20}{\sqrt{2}} = \sqrt{2} = 1.41\text{A} \]
Since \( X_L = X_c \); this is the condition of resonance and in this condition \( V = V_r \)
\[ = iR = 1.4 \times 4 = 5.6 \text{ V.} \]

8. \[ d_{xy} = \frac{d_1}{n_1} + \frac{d_2}{n_2} \]

10. \[ N_x = N_0 \left( \frac{1}{2^{x/y}} \right) = \frac{N_0}{2^x} \]
\[ N_y = \frac{N_0}{2^y} \]
\[ \frac{N_x}{N_y} = \frac{1}{4} \]

11. When the key is at position (2) for a long time; the energy stored in the inductor is:
\[ U_B = \frac{1}{2} L i_0^2 = \frac{1}{2} L \left( \frac{E}{R_2} \right)^2 = \frac{LE^2}{2R_2^2} \]

12. The given current is a mixture of a dc component of 3A and an alternating current of maximum value 6A.
Hence r.m.s. value
\[ = \sqrt{(dc)^2 + (\text{r.m.s. value of ac})^2} \]
\[ = \sqrt{3^2 + \left( \frac{6}{\sqrt{2}} \right)^2} = \sqrt{3^2 + \left( \frac{3\sqrt{2}}{2} \right)^2} \]
\[ = 3\sqrt{3} \text{ A} \]

13. \[ m = \frac{f}{u - f} \]
\[ m = \frac{f}{-x - f}, \quad m' = \frac{f}{-y - f} \]
\[ \Rightarrow m' = -m \]
\[ \Rightarrow \frac{f}{-y - f} = \frac{-f}{-x - f} \]
\[ \Rightarrow f = \left( \frac{x + y}{2} \right) \]

14. \[ \frac{2\lambda}{d} \times D = d \]
\[ D = \frac{d^3}{2\lambda} \]

16. \[ e = (\vec{v} \times \vec{B}).\overrightarrow{\ell} \]
\[ e = [\hat{i} \times (3\hat{i} + 4\hat{j} + 5\hat{k})].\overrightarrow{\ell} \Rightarrow e = 25 \text{ volt} \]

17. \[ v_0 = \frac{1}{2\pi\sqrt{LC}} \Rightarrow \text{In this question} \]
\[ L' = L + 25\% \text{ of } L = L + \frac{L}{4} = \frac{5L}{4} \text{ and} \]
\[ C' = C - 20\% \text{ of } C = C - \frac{C}{5} = \frac{4C}{5} \]
Hence \[ v'_0 = \frac{1}{2\pi\sqrt{L'C'}} = \frac{1}{2\pi\sqrt{\frac{5L}{4} \times \frac{4C}{5}}} \]
\[ = \frac{1}{2\pi\sqrt{LC}} = v_0 \]
18. \( f_1 = 40\text{ cm}, f_2 = -25\text{ cm} \)

Power of resultant combination

\[
P = P_1 + P_2 = \frac{100}{40} + \frac{100}{-25}
\]

\[
P = 2.5 - 4 = -1.5\text{ D}
\]

19. \( P = \frac{n(hv)}{t} \)

\( \Rightarrow \) No. of photon per sec incident

\[
= \frac{10^{-3} \times 5000 \times 1.6 \times 10^{-19}}{2400}
\]

\[
= 2.5 \times 10^{17}
\]

\( i = \frac{ne}{t} \)

Total no. of electron per lec produce

\[
= \frac{0.16 \times 10^{-6}}{1.6 \times 10^{-19}} = 1 \times 10^{12}
\]

\[\Rightarrow 1 \times 10^{12} \times 100 = 0.04\%
\]

20. \( m_1 v_1 = m_2 v_2 \)

\[
\frac{m_1}{m_2} = \frac{v_2}{v_1} = \frac{1}{2}
\]

\[
\frac{r_1}{r_2} = \left(\frac{m_1}{m_2}\right)^{\frac{1}{3}} = \frac{1}{2^{\frac{1}{3}}}
\]


This length will move at a speed \( v \) perpendicular to the field. This results in an induced emf: \( e = Bv(2R) \) in the ring.

![Diagram](image)

In Ring "A" : \( eA = B(-v)(2R) \)

In Ring "B" : \( eB = B(v)(2R) \)

Therefore, potential difference between A & B = \( B(v)(2R) - B(-v)(2R) = 4BvR \).

Note: there will be no p.d. across a diameter due to rotation.

Alternate – Considering rotation of diameter about lowest point:

\[
e = \frac{Bo(2r)^2}{2} = 2Bvr \text{ in } A \quad \text{(since pure rotation)}.
\]

And \( e = -2Bvr \text{ in } B. \) Hence (3)

22. \( V = V_0 \sin \omega t \)

\[
I = I_0 \sin \left(\omega t - \frac{\pi}{2}\right)
\]

\( I = -I_0 \cos \omega t \)

So instantaneous power

\[
|P| = IV = I_0V_0 \cos \omega t \sin \omega t
\]

\[
= \frac{I_0V_0}{\sqrt{2}} \cdot \frac{2}{\sqrt{2}} \cdot \sin \omega t \cos \omega t
\]

\[
= I_{mv}V_{mv} \sin 2\omega t
\]

So angular frequency = 2\( \omega \)

23. Angular magnification \( |m| = \frac{f_0}{f_e} = 5 \)

\[\Rightarrow f_0 = 5f_e \]

distance between objective and eye-piece = \( f_0 + f_e = 36 \)

\( 5f_e + f_e = 36 \Rightarrow f_e = 6\text{ cm} \)

and \( f_0 = 30\text{ cm} \)

24. \( k_{max} = \frac{h \nu - \phi}{\nu} = \nu f_0 \)

\( k_{max} = \nu f_1 - \nu f_0 \)

\( k_{max} = h(f_1 - f_0) \)

25. First diode is in reverse biasing it acts on open circuit hence no current flows.

26. \( \eta = \frac{P_2}{P_1} \times 100 \quad \text{or} \quad \eta = \frac{140}{240 \times 0.7} \times 100 = 83.3\% \)

27. Observer

(\( \mu \text{ m} \))

\[
\sin \theta_c = \frac{1}{\mu}
\]

\[
\frac{60}{100} = \frac{1}{\mu}
\]

\( \mu = 1.67 \)
29. Saturation current is proportional to intensity while stopping potential increases with increase in frequency. Hence A & B same intensity. B & C same frequency. Therefore, the correct option is (1)

30. At high reverse voltage, the minority charge carrier acquire very high velocities. These by collision break down the covalent bonds, generating more carriers. This mechanism is called avalanche breakdown.

31. \[ q = \frac{1}{R} \frac{d\phi}{d\theta} = \frac{1}{R} (\phi_2 - \phi_1) \]
\[ \phi_1 = NBA \cos \theta \quad (\theta = 0) \]
\[ \phi_1 = NBA \]
\[ \phi_2 = 0 \quad [\therefore \theta = 90^\circ] \]
\[ q = \frac{NBA}{R} \]

32. \[ \frac{1}{f_a} = (\mu - 1) \left( \frac{1}{R_1} \frac{1}{R_2} \right) \]
\[ \therefore 3 = (1.25 - 1) \left( \frac{1}{R_1} \frac{1}{R_2} \right) \quad \text{....(1)} \]
 Also, \[ -2 = \left( \frac{1.25}{\mu - 1} \right) \left( \frac{1}{R_1} \frac{1}{R_2} \right) \quad \text{....(2)} \]
\[ \frac{1}{f_a} = (\mu - 1) \left( \frac{1}{R_1} \frac{1}{R_2} \right) \]
\[ \Rightarrow \mu = 1.5 \]

34. \[ p = \frac{h}{\lambda} \]
\[ \text{K.E.} = \frac{p^2}{2m} = \frac{h^2}{2m\lambda^2} \]
If entire K.E. of electron is converted into photon then
\[ \frac{h^2}{2m\lambda^2} = \frac{he}{\lambda_o} \quad \lambda_o = \frac{2mc\lambda^2}{h} \]

35. \[ \text{AND + NOT = NAND} \]

36. \[ \frac{1}{2} L_i^2 = 5 \Rightarrow L = 5 \times 2 \]
\[ fR = 10 \Rightarrow R = 10 \quad \Rightarrow \tau = 1 \text{ sec.} \]

37. At minimum deviation, \[ \mu = \frac{\sin \left( \frac{30^\circ + 60^\circ}{2} \right)}{\sin \left( \frac{60^\circ}{2} \right)} = \frac{\sin 45^\circ}{\sin 30^\circ} = \frac{1}{\sqrt{2}} \times 2 = \sqrt{2} \]
As, \( \mu = \sqrt{2} \), the ray suffers minimum deviation through the prism. Thus, it is parallel to the base of prism.

38. \[ \beta = \frac{I_1}{I_2} \]
fringe visible \[ = \frac{I_{\text{max}} - I_{\text{min}}}{I_{\text{max}} + I_{\text{min}}} = \frac{2\sqrt{I_{12}}}{I_1 + I_2} \]
\[ = \frac{2\sqrt{I_1}}{I_1 + 1} + \frac{2\sqrt{\beta}}{1 + \beta} \]

39. If (i) both are neutrons (ii) one is proton, other is neutron only nuclear force exists which is attractive at separation 1 fm but if both are protons then both electric (here repulsive) and nuclear force exists.
\[ \therefore \text{net force attractive but its magnitude decreases.} \]
\[ F_1 = F_3 > F_2 \]

40. \[ I_{\text{in}} = \frac{20 - 5}{2 \times 10^1} \quad \text{A} = 7.5 \text{mA} \]
\[ I_1 = \frac{5}{10^1} \quad \text{A} = 5 \text{mA} \]
\[ I_2 = 2.5 \text{mA} \quad [\therefore I_{\text{in}} = I_2 + I_1] \]

42. \[ u = \infty, v = -40 \text{ cm} \]
\[ \frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow f = -40 \text{ cm} \]
\[ P = \frac{100}{-40} = -2.5 \text{ D} \]

44. \[ ^{226}_{88}\text{Ra} \rightarrow ^{206}_{82}\text{Pb} \]
\[ \text{no. of } \alpha = \frac{226 - 206}{4} = 5 \]
\[ \text{no. of } \beta = 82 - (88 - 5 \times 2) = 4 \]
45. \[ V_L = I_L R_L = \beta L R_L = (100)(2 \times 10^{-3})(0.25) = 5 \times 10^{-2} \text{ V} = 50 \text{ mV} \]

46. CaCl₂ reduces the melting point of the mixture.

47. \[ 2A(g) \rightarrow B(g) + C(s) \]
at t = 0 \[ P_0 \]
at t = 10min. \[ P_0 - x \]
at completion \[ 0 \]

\[ P_0 - \frac{x}{2} = 300 \quad \text{(1)} \]

\[ \frac{P_0}{2} = 200 \quad \Rightarrow P_0 = 400 \]

\[ x = 200 \]

\[ \therefore k = \frac{2.303}{10}\log \frac{400}{200} = 0.0693 \text{ min}^{-1} \]

48. \[ \text{Br}_2 \text{ undergoes disproportionation, i.e. it undergoes both oxidation & reduction.} \]

50. NCERT XII/II-part, Pg.# 447

51. Fact

53. \[ \text{NH}_3\text{OH} \rightarrow \text{N}_2\text{O} \quad -1 \quad +1 \]

\[ \therefore \text{V.f. of NH}_3\text{OH} = 2 \]

\[ \therefore \text{Eq wt = M/2} \]

54. NCERT XII II part Pg.# 428

55. BHC is an insecticide

56. Fact

57. \[ B + 3D \rightarrow 4A + 2C \]

58. Milli equivalents of FeC₂O₄ = 0.1 \times 3 \times 25 = 7.5

From choice (4), milli equivalents of KMnO₄ = 0.1 \times 5 \times 15 = 7.5

\[ \therefore \text{m. eq. of FeC}_2\text{O}_4 = \text{m. eq. of KMnO}_4 \]

60. \[ \text{CH}_3\text{C}═\text{C}═\text{OH} \]

\[ \text{NH}_3\]

Alanine

61. Fact

62. \[ r_f = -\frac{1}{2} \frac{d[\text{NO}_2]}{dt} = K_1 [\text{NO}_2]^2 \]

\[ -\frac{d[\text{NO}_2]}{dt} = 2K_1 [\text{NO}_2]^2 \quad \text{..(i)} \]

\[ r_b = K_2 [\text{N}_2\text{O}_4] \]

\[ \frac{d[\text{NO}_2]}{dt} = 2K_2 [\text{N}_2\text{O}_4] \quad \text{..(ii)} \]

\[ \therefore \text{Net rate of consumption of NO}_2 = (1) \quad \text{..(iii)} \]

63. \[ 1 + (-3) + a = 0 \]

\[ \therefore a = +2 \]

64. NCERT XI II part Pg.# 409

65. NCERT XII, II part Pg.# 409

66. due to \( \Delta_t < \text{P.E.} \)

69. NCERT XI II part Pg.# 400

71. \[ K = \frac{1}{\beta_4} \]

\[ = \frac{1}{2.1 \times 10^{13}} \]

\[ = 4.7 \times 10^{-14} \]

72. Cell count \( G^* = \frac{0.02}{0.0004} \)

\[ G = \frac{1}{R} = \frac{1}{50} \]

\[ K = G \times G^* = \frac{1}{50} \times \frac{0.0200}{0.0004} = 1 \text{ Sm}^{-1} \]

74. NCERT XI II part Pg.# 400

75. NCERT XII, II part Pg.# 414

76. It has Mg not Ca

77. wt of Ag deposited = 0.1 \times 108 = 10.8

wt of O₂ = 0.1 \times 8 = 0.8 g

wt of resulting solution = 108 – 10.8 – 0.8 = 108 – 11.6 = 96.4 g

79. NCERT XII II part Pg.# 444
80. Bromine water can oxidise glucose but unable to oxidised fructose

81. Fe\(^{+2}\) = [Ar] 3d\(^6\) 4s\(^0\)
   CN\(^-\) is a strong field ligand
   \[
   \begin{array}{cccc}
   1 & 1 & 1 \\
   \end{array}
   \]
   \[
   \text{d'sp}^3
   \]
   \# unpaired e\(^-\) = \[\text{Zero}\]
   \therefore \text{ This complex would be Diamagnetic.}

83. NCERT XII II part Pg.# 436
84. NCERT XII II part Pg.# 355
85. \((\text{NH}_4)_2\text{SO}_4\cdot\text{FeSO}_4 \cdot 6\text{H}_2\text{O}\)
   \[2\text{NH}_4^+\cdot\text{Fe}^{+2}\cdot 2\text{SO}_4^{2-} = 5 \text{ Ions}\]
   \text{two type of cation}

86. \(K = Ae^{-Ea/RT}\)
87. \(\text{H}_2(\text{P}_1) + 2\text{H}^+(\text{ag}) \rightarrow 2\text{H}^+(\text{ag}) + \text{H}_2(\text{P}_2)\)
   \[
   Q = \frac{P_2}{P_1}
   \]
   \[
   E = 0 - \frac{RT}{2F} \log \frac{P_2}{P_1}
   \]
   \[
   E = \frac{RT}{2F} \log \frac{P_1}{P_2}
   \]
88. NCERT XII II part Pg.# 430
89. \[\text{Paracetamol}\]
90. \([\text{Fe(H}_2\text{O})_6]^{+3}\ \text{Fe}^{+3} = 3d^5\]
   \[t_{2g}^3 = e_g^2\]
   CFSE = \(-0.4 \times 3 + 0.6 \times 2\)
   CFSE = \[\text{zero}\]